

Public workshop on Lead-Acid Batteries and Alternatives

Ioniq HEV & Niro HEV presentation

!beyond! THE CAR



2017.11.06

CalEPA Headquarters, Sacramento

Hyundai-Kia America Technical Center, Inc. – Chino Lab, California

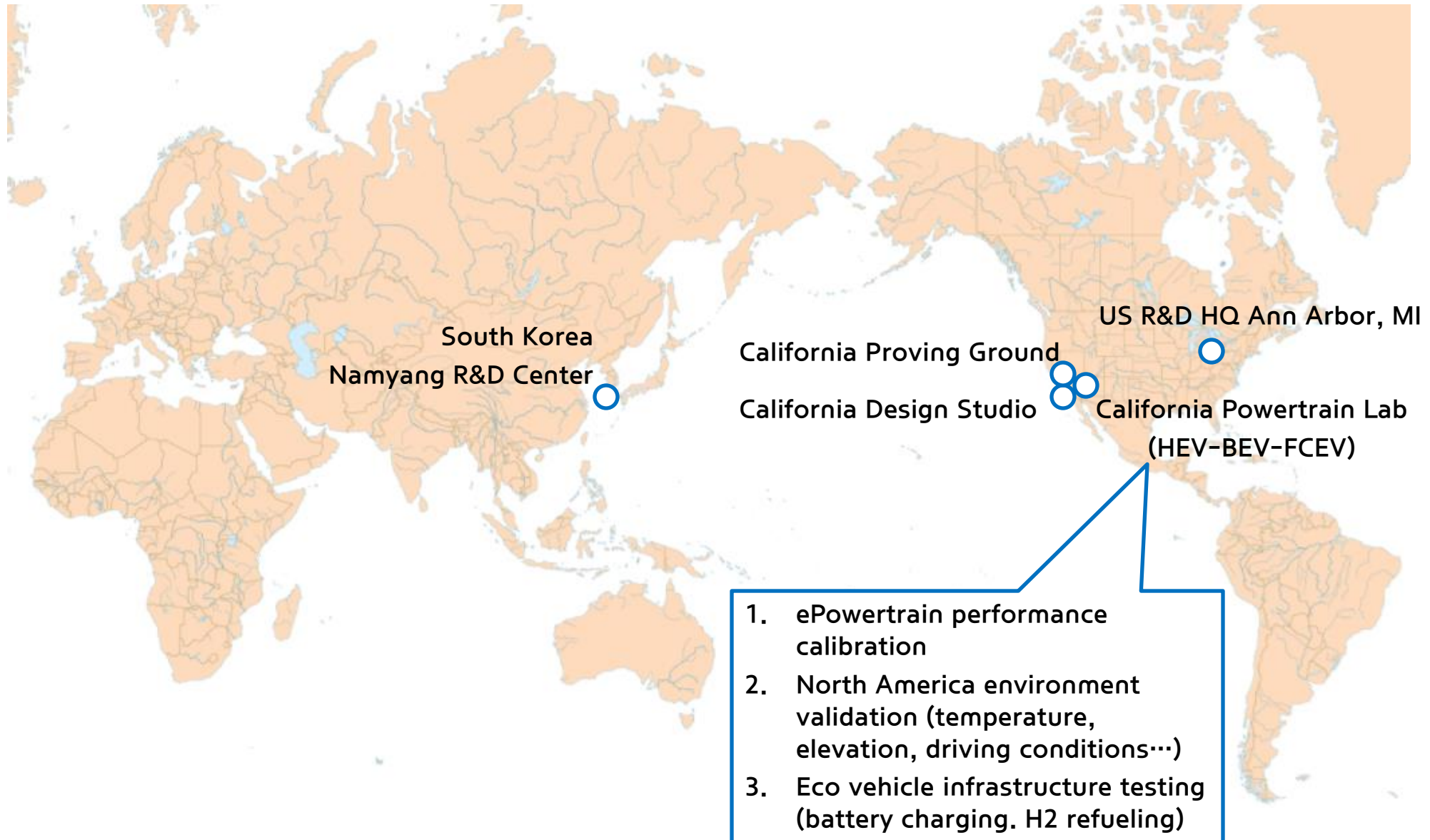
Powertrain Eco Team Senior Manager

Jerome Gregeois



Hyundai Motor Group R&D overview

2



Ioniq HEV within Hyundai Motor Group ECO line up

3



Hyundai Sonata Hybrid
2011



Hyundai Sonata Plugin Hybrid
2016



2017 Hyundai Ioniq
World's most fuel efficient vehicle
58 mpg combined (*blue trim)



Hyundai Tucson Fuel Cell
2014



Kia Soul BEV
2014



2017 Kia Niro
World's most fuel efficient CUV
50 mpg combined (*FE trim)

Ioniq HEV – World's most fuel efficient vehicle

4



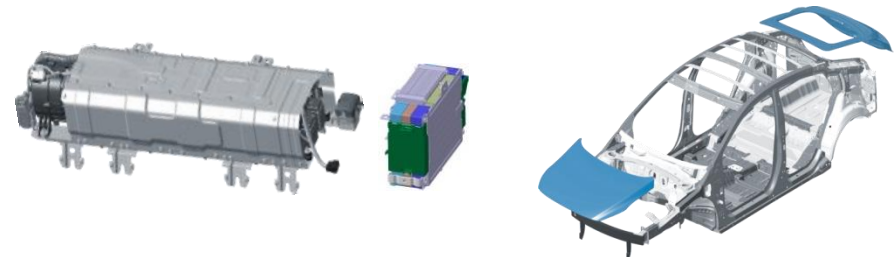
1. Ultra efficient powertrain



2. Excellent aero



3. Weight reduction



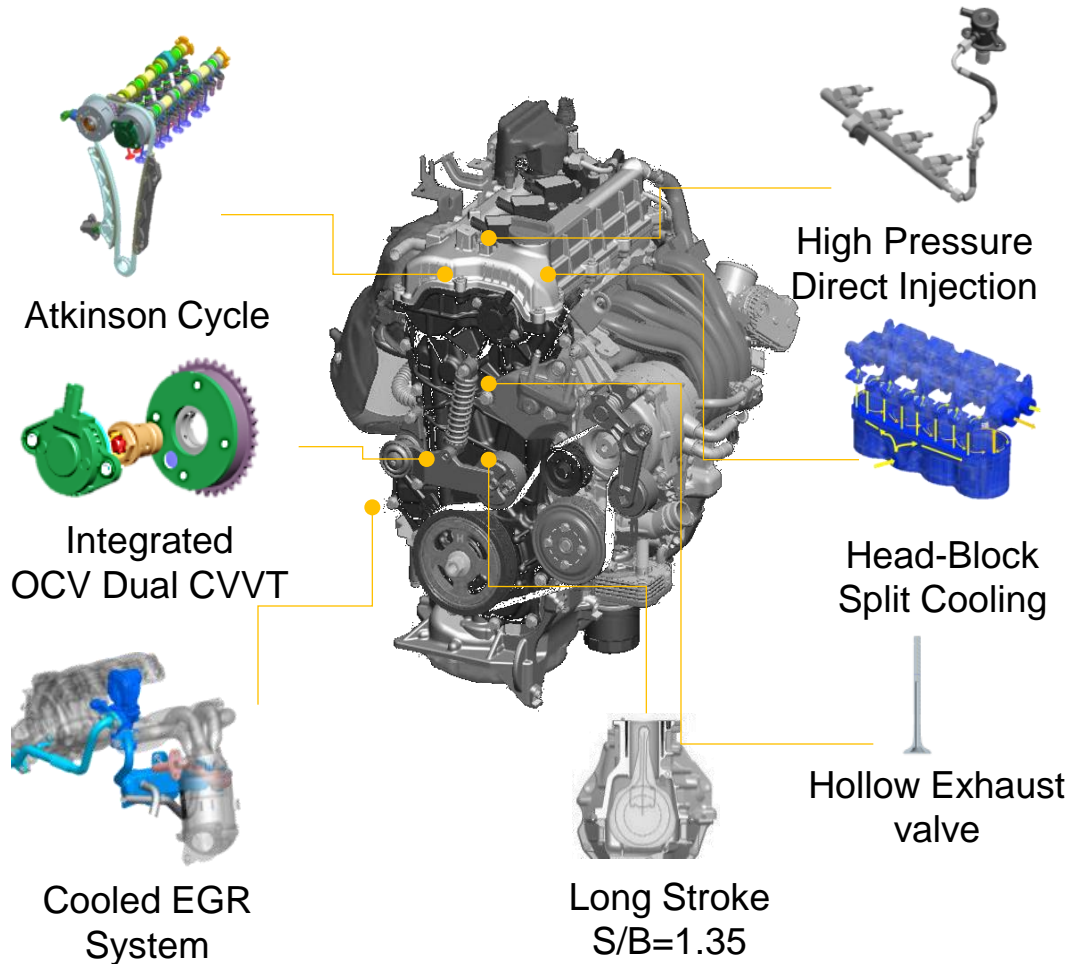
Together We can!

This report (including any attachments) is a confidential and classified document. The publication or distribution of this report or the information contained herein must not be disclosed without the written approval of the author.

Ioniq HEV – Powertrain efficiency

5

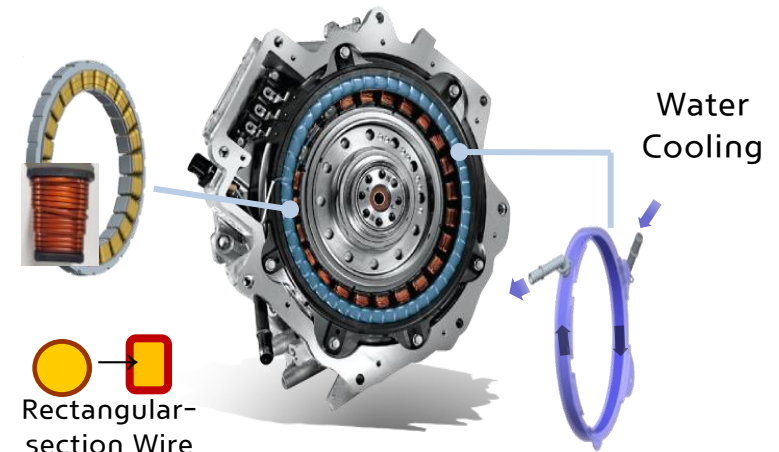
40% efficient Engine



95.7% efficient DCT transmission



95% efficient eMotor



Together We can!

This report (including any attachments) is a confidential and classified document. The publication or distribution of this report or the information contained herein must not be disclosed without the written approval of the author.

Drag Coefficient

0.24



IONIQ



- **Sleek Profile**
Streamlined profile minimizes air resistance



- **Wheel Air Curtain**
Accelerated air flow forms a curtain that reduces turbulent air drag



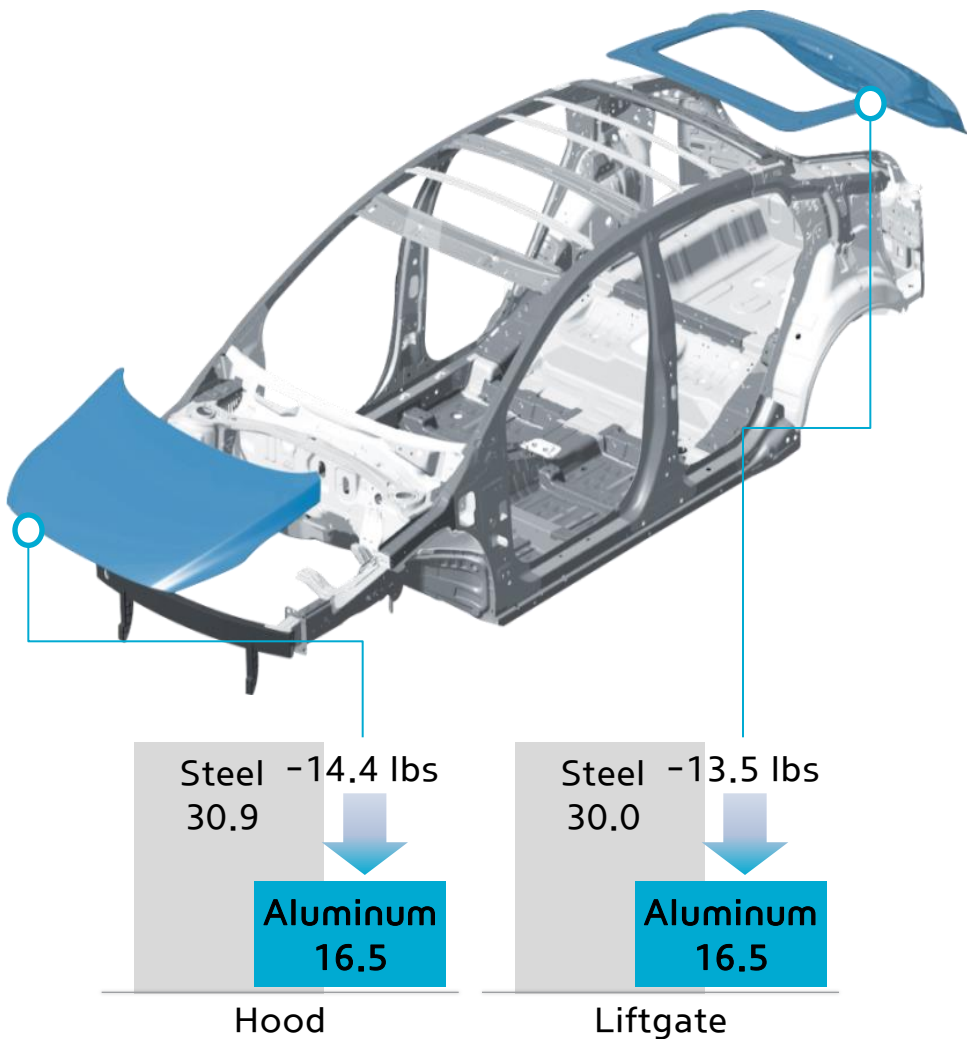
- **Rear Spoiler**
Purposeful design element that reduces drag effect and provides downward force



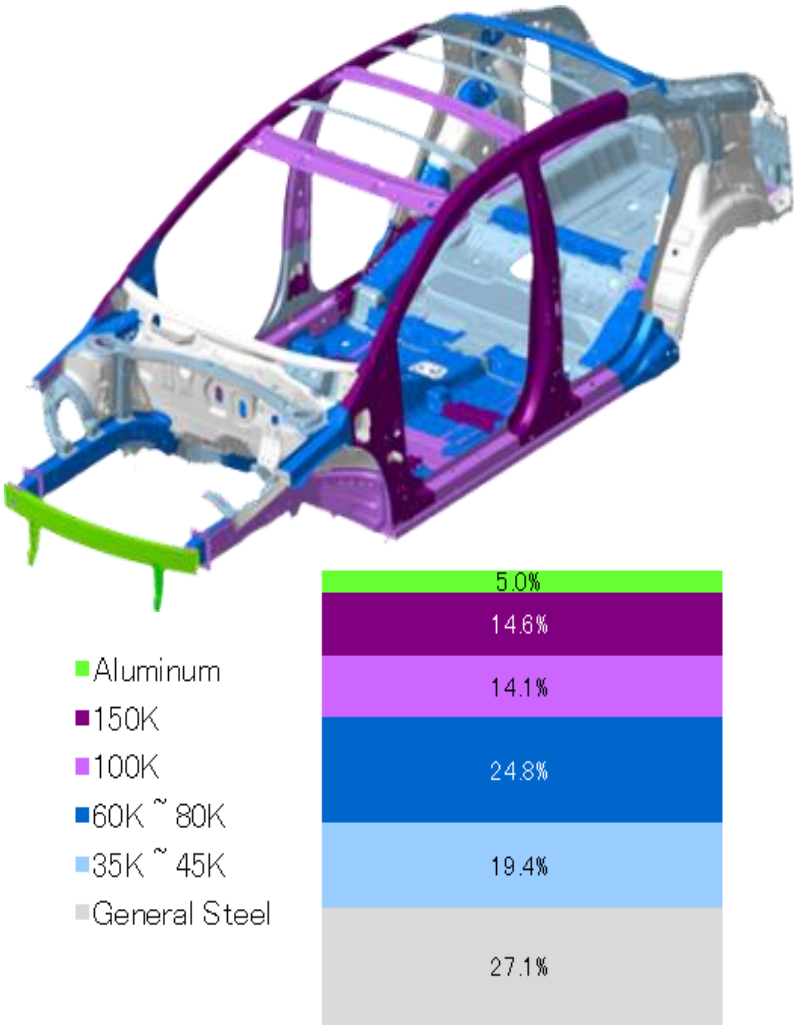
- **Underbody Cover**
Allows for smooth air flow underneath the vehicle

Ioniq HEV – Weight reduction (1/2)

Strategic Use of Aluminum



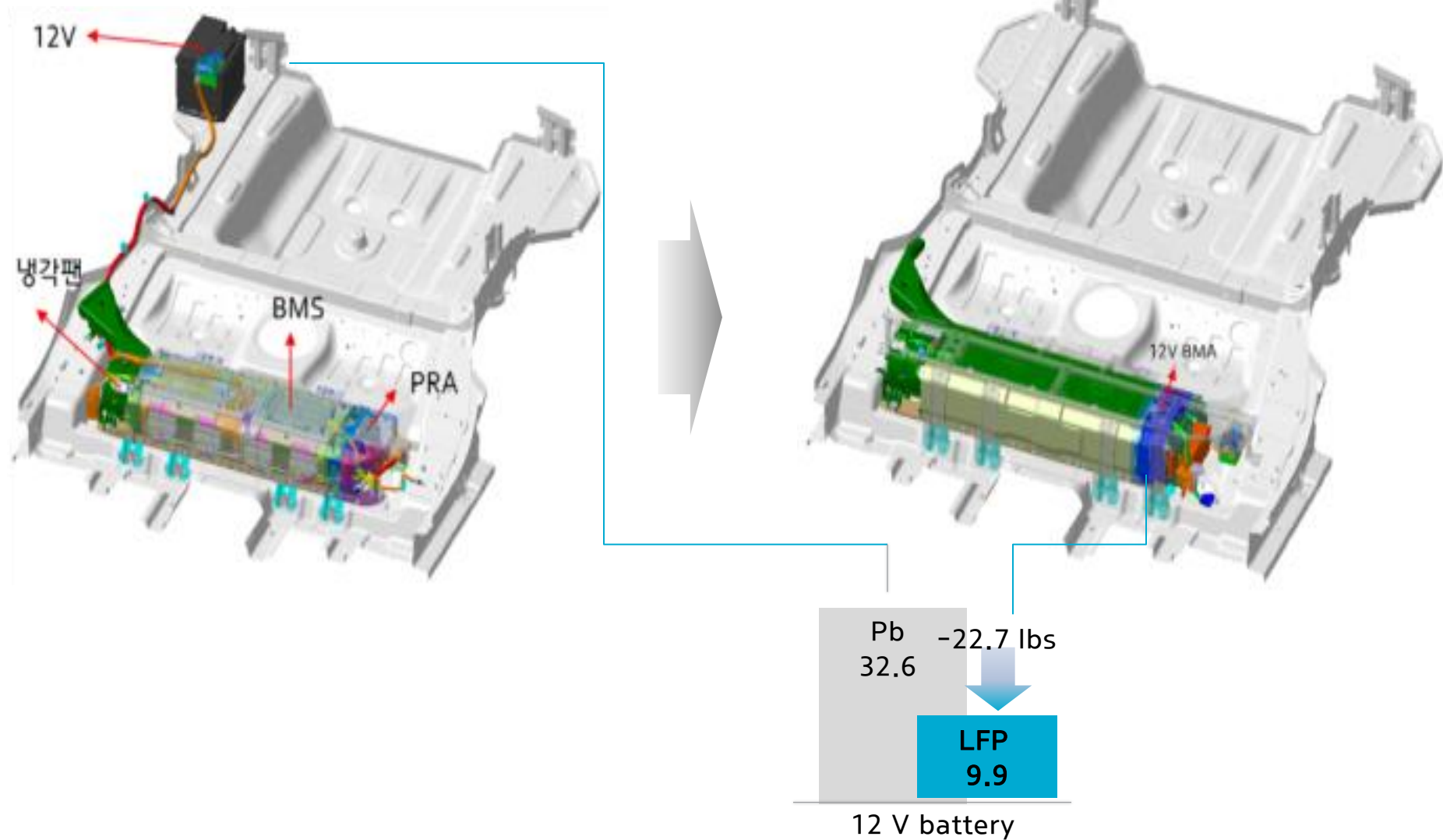
Steel Application Type (% of BIW)



Ioniq HEV – Weight reduction (2/2)

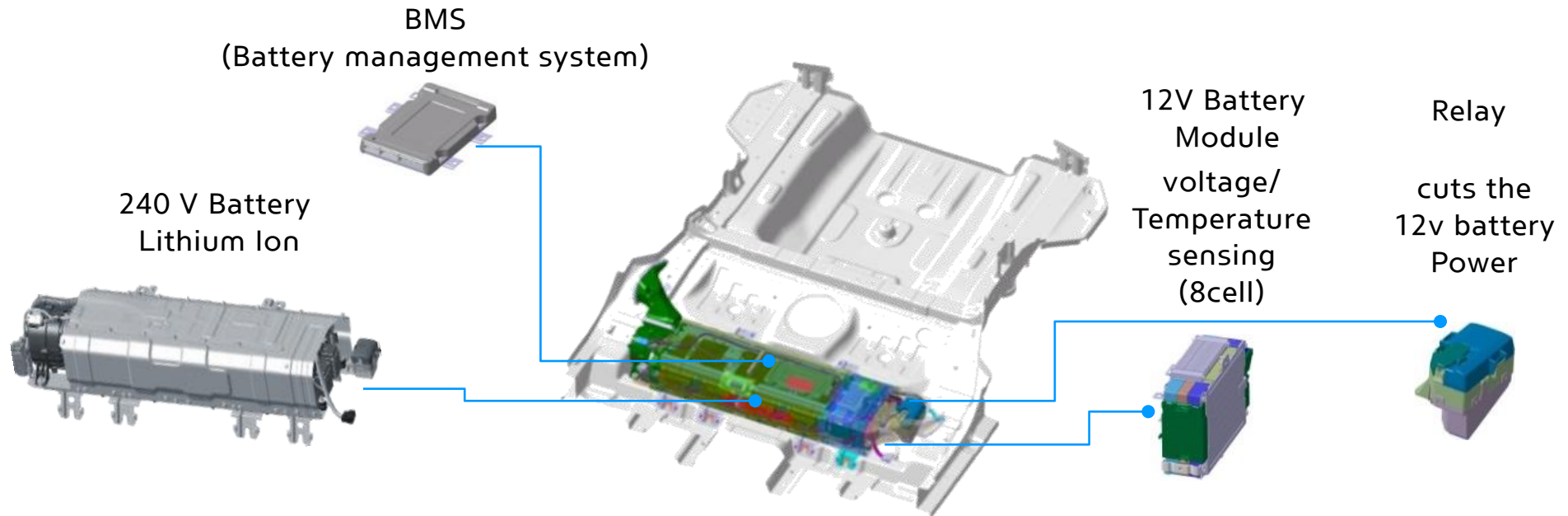
Korean Market Ioniq/Niro Battery system

North American Market Ioniq Battery system



Ioniq HEV – Battery system details

9



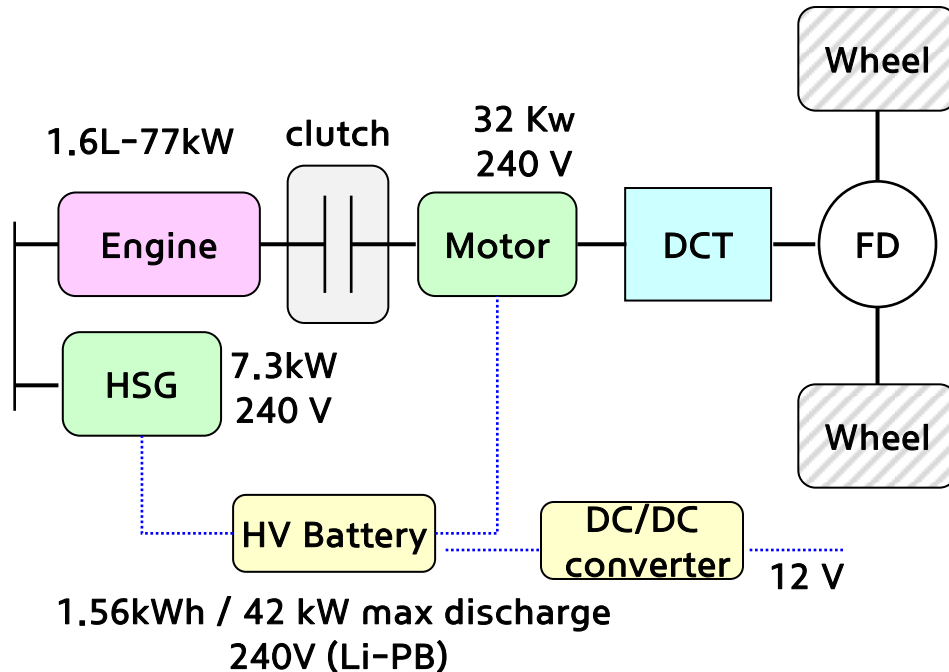
HV	Specification
Type	Lithium-Ion Polymer (LG Chem)
Cell	64
Voltage	240 V
Capacity	1.56 kWh (6.5Ah)
Max output	42 kW
SOC range	40~60% normal operation
Efficiency	94.3 %
Cooling	Forced cabin air

LV	Specification	Details
Type	Lithium Iron Phosphate (LG Chem)	LDC H/W is same as domestic vehicle
cell	8 cells	4S 2P
voltage	OCV 12.8V (Operation: 10~14.8V)	Cell's OCV: 3.2V (Operation: 2.5~3.7V)
Capacity	30Ah	Similar to 12v Pb battery (50Ah)
Max output	1.8 kW	-
Range of SOC	0 ~ 100%	Operation: 100 ↔ 65% (Pb battery : Operation 100~80%,
Efficiency	98.7%	
Cooling	Forced cabin air	Integrated with HV and 12V battery

Ioniq HEV – Low & High voltage components

10

Ioniq / Niro HEV powertrain schematic



Key functions of High Voltage system

1. HSG (Hybrid starter generator)

- HSG starts the engine
- HSG is used as a generator to charge the HV battery when the primary traction motor can not be used (ie in serie operation with clutch open)

2. Traction motor

- Operates the vehicle in EV mode (ICE shut when possible and most fuel efficient).
- Used as generator to recharge the battery during coast down and regeneration braking operation

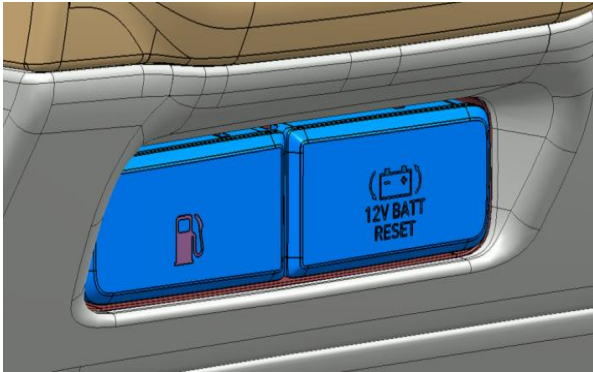
3. High Voltage battery

- Powers HV components (HSG, eMotor, AC compressor)
- Balances powertrain efficiency (recharges during regen braking or inefficient ICE operation or powers emotor to assist ICE)

Ioniq HEV – Special feature for 12 V Lithium Iron low SOC

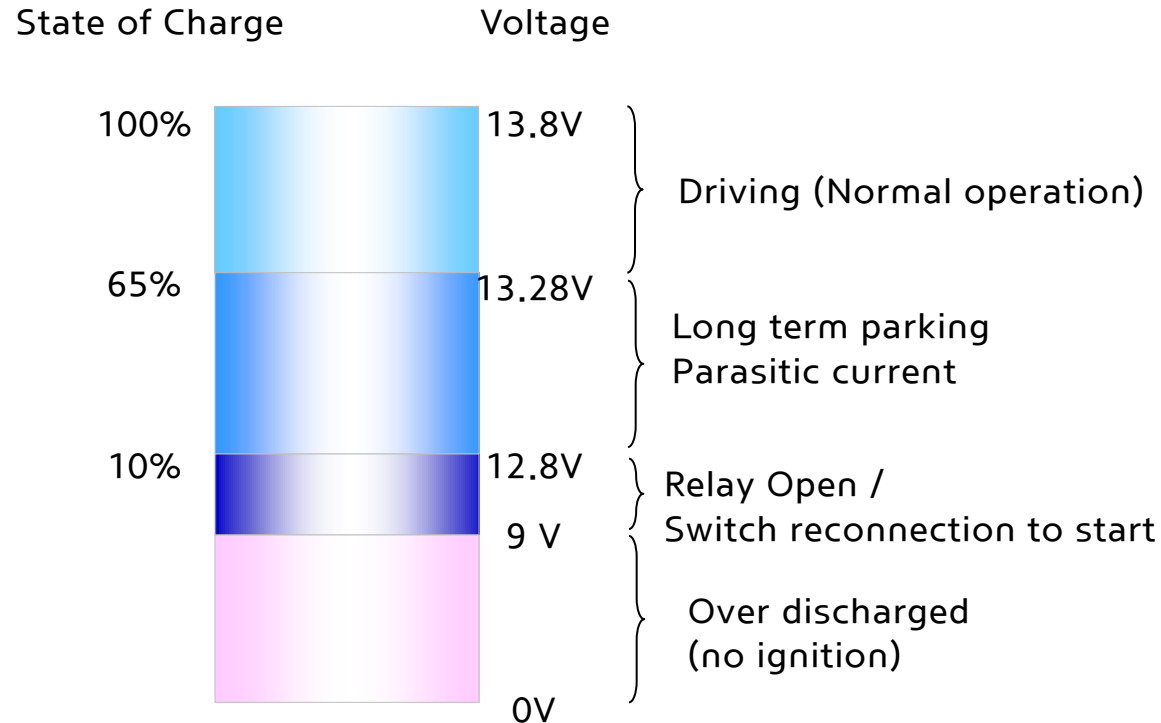
11

“Self jumping” function



- The battery protection system cuts 12V battery from vehicle draw to prevent full discharge when:
 - The battery voltage is between 12 ~ 9V
 - The state of charge is too low.
- When the BMS open the 12v latch relay, the vehicle appears to have a discharged 12v battery

12V Battery management

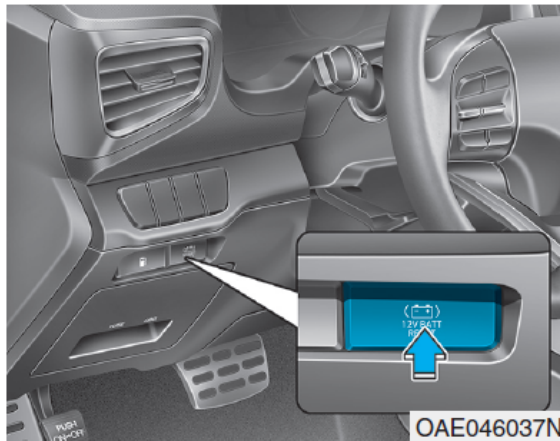



Ioniq HEV – Special feature for 12 V Lithium Iron low SOC

12

Service manual extract for 12 V battery reset

Using the 12V Battery Reset Switch




1. Press the 12V Battery Reset switch to reconnect the 12V battery.
2. Start the vehicle within 15 seconds of pressing the 12V Battery Reset switch.
3. After starting vehicle ( indicator on), operate the vehicle safely outdoors in ready mode stopped and/or drive it for 30 minutes total to charge the 12V battery fully.

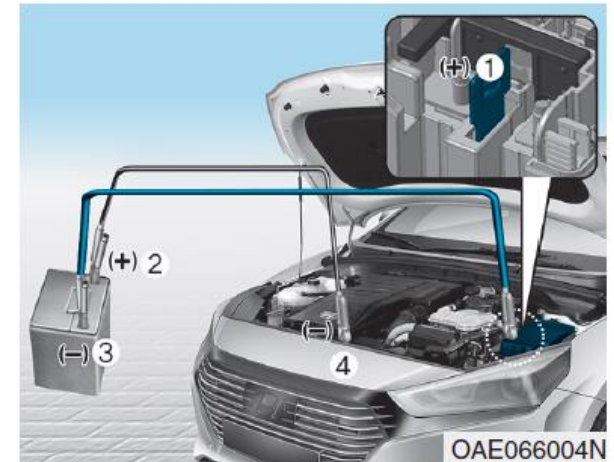
If you do not start the vehicle immediately after pressing the 12V Battery Reset switch, the power of 12V battery is automatically disconnected after few seconds to save the 12V battery from additional discharge. If the 12V battery is disconnected prior to starting the vehicle, press the 12V Battery Reset switch again and then immediately start the vehicle as explained.

Repeated use of the 12V Battery Reset switch without a sufficient engine ON cycle (30 Min+) may cause over discharge of the 12V battery, which will prevent the vehicle from starting. If the 12V battery is over discharged to a point that the reset does not work, try to jump-start the vehicle.

Information

After starting the vehicle ( indicator on), the 12V battery is being charged whether the engine is running or not. Although there is no engine-sound, it is unnecessary to depress the accelerator pedal.

“conventional jump start is available, followed by 12 V reset and engine start



4. Connect the jumper cables in the exact sequence shown in the illustration. First connect one jumper cable to the red, positive (+) jumper terminal of your vehicle (1).
5. Connect the other end of the jumper cable to the red, positive (+) battery/jumper terminal of the assisting vehicle (2).
6. Connect the second jumper cable to the black, negative (-) battery/chassis ground of the assisting vehicle (3).

Niro HEV – Interesting facts

13



Consumer Reports names the 10 most reliable cars

Chris Woodyard, USA TODAY Published 5:22 a.m. ET Oct. 28, 2017 | Updated 1:52 p.m. ET Oct. 28, 2017

1. Kia Niro
2. Subaru BRZ/Toyota 86 (tie)
3. Lexus ES (tie)
4. Lexus GS
5. Audi Q3 (tie)
6. Toyota RAV4 (tie)
7. Lexus IS
8. Toyota Prius V



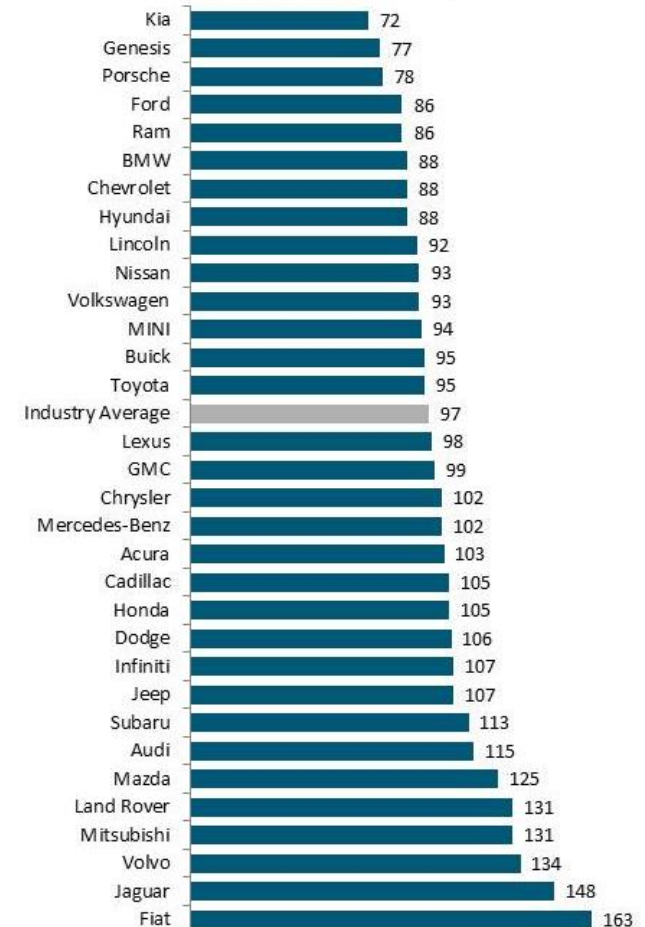
Consumer Reports' Top 10 most reliable cars

The most reliable model for 2017: Kia's Niro hybrid GREG JAREM



J.D. Power 2017 U.S. Initial Quality StudySM (IQS)

2017 Nameplate IQS Ranking Problems per 100 Vehicles (PP100)

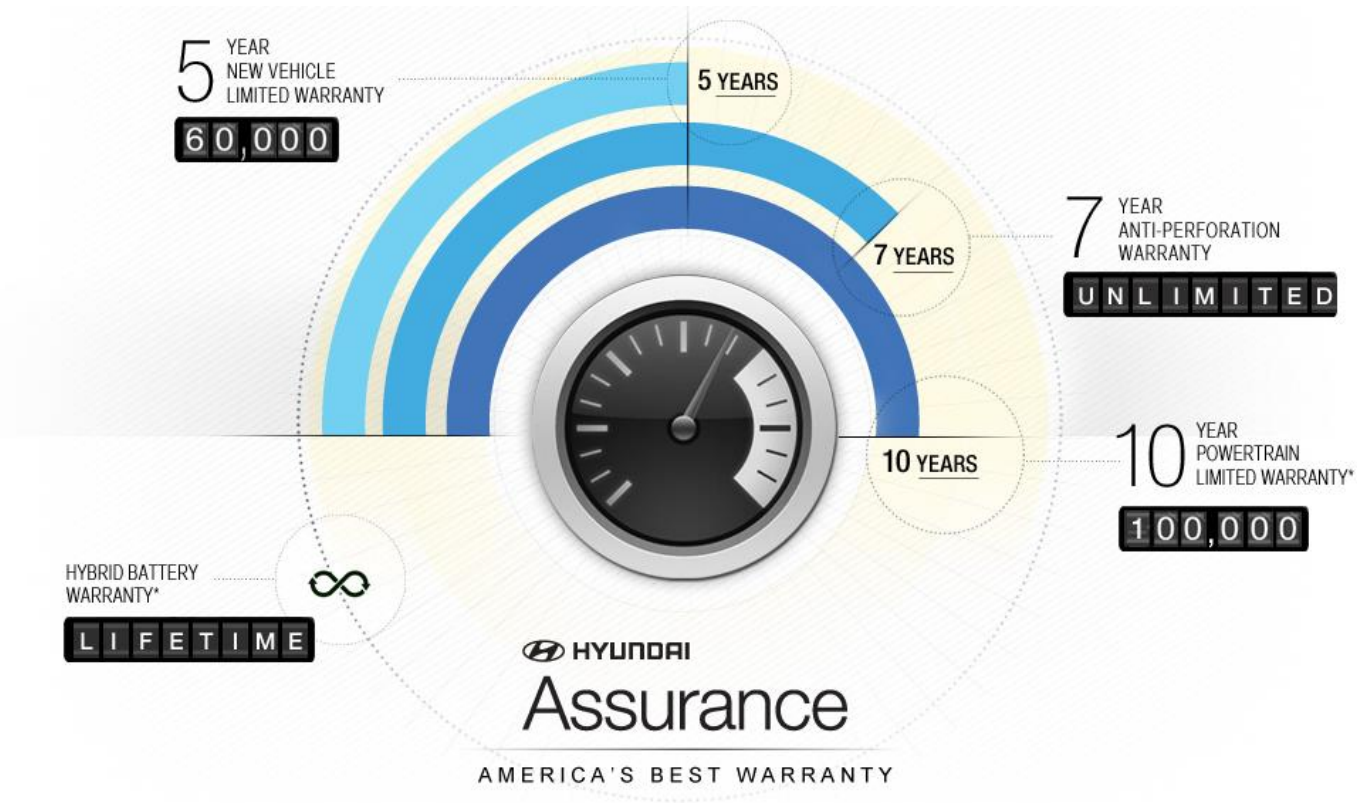


Together We can!

This report (including any attachments) is a confidential and classified document. The publication or distribution of this report or the information contained herein must not be disclosed without the written approval of the author.

Ioniq HEV – Interesting facts

14



10-YEAR/100,000-MILE POWERTRAIN WARRANTY*	5-YEAR/60,000-MILE NEW VEHICLE LIMITED WARRANTY	7-YEAR/UNLIMITED MILES ANTI-PERFORATION WARRANTY	5-YEAR/UNLIMITED MILES 24-HOUR ROADSIDE ASSISTANCE
12-MONTH/12,000-MILE REPLACEMENT PARTS AND ACCESSORIES LIMITED WARRANTY	7-YEAR/70,000-MILE CALIFORNIA EMISSION CONTROL SYSTEMS WARRANTY	8-YEAR/80,000-MILE FEDERAL EMISSION DEFECT & PERFORMANCE WARRANTY	LIFETIME HYBRID BATTERY WARRANTY*

*Original owner only.

Ioniq HEV – Interesting facts

15

Proof in Performance

► Ioniq HEV prepared to set new Land Speed World Record

Location: Bonneville, Utah

Date: Sept 2016

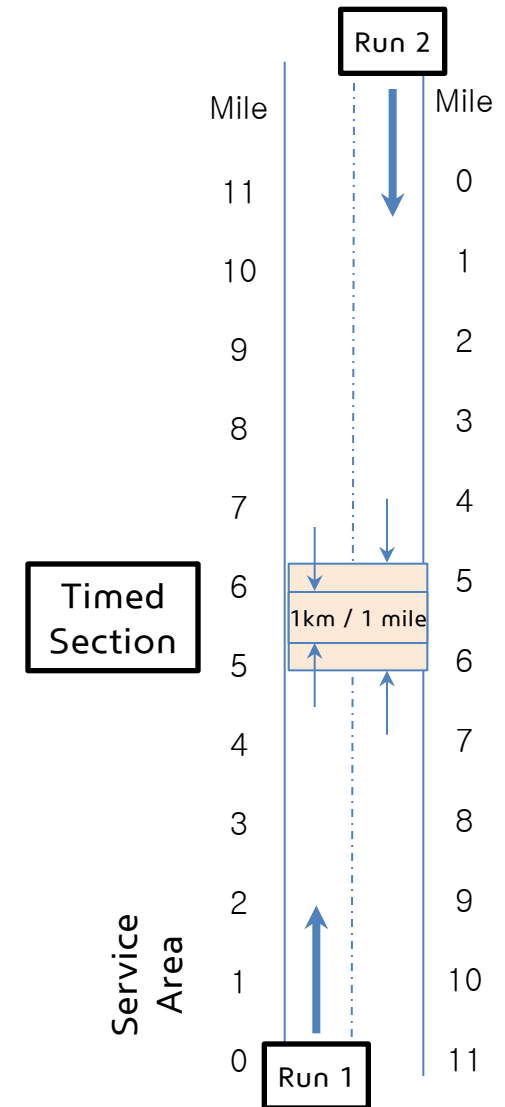
Elevation: 4,200ft (1285m)



11 Mile Course is made from grading
& packing the salt.

► Rules:

- Speed is only measured between mile 5 and 6 in a “flying mile” format
- Average speed includes both directions (to compensate for wind and slope)



FIA world speed record (Category A, Group XI, Class 3)

Ioniq HEV sets new FIA Land Speed World Record (Federation Internationale De L'Automobile)

Record: 157mph (252kph) average – Exit: 160mph (275kph)

Category A, Group XI (hybrid), Class 3 (under 1500kg)



Production model specifications

Gasoline Engine	Displacement	1.6L GDI I4 Kappa	
	Cycle	Atkinson	
	Power (kW)	77kW (104hp)	
	Torque (Nm)	147Nm (109lb-ft)	
Electric Motor	Power (kW)	32 kW (43hp)	
	Torque (Nm)	170Nm (125lb-ft)	
Battery System High voltage	Capacity (Ah)	6.5 Ah (240V)	
	Type	Lithium-Ion Polymer	
Battery system Low voltage	Capacity	30 Ah (12V)	
	Type	Lithium Iron Phosphate	
	Voltage	240V	
Transmission		6-speed DCT	
Hybrid System Net Power		103kW (139hp)	
Fuel Economy	MPG (Blue/FE)	57/59/58	52/49/50
	MPG (SEL/Lim & Niro/Touring)	55/54/55	51/46/49 & 46/40/43

THANK YOU FOR YOUR ATTENTION

